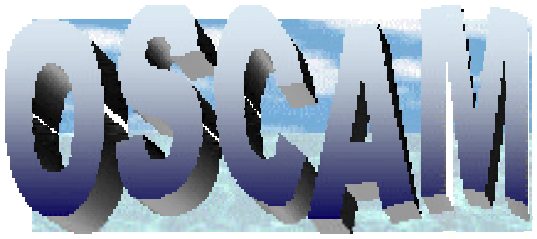


"*Operating and Support Cost Analysis Models for Ships and Ship Systems*"

DODCAS Symposium

Naval Center for Cost Analysis

Mr. Paul Hardin

4 February 1999

Outline

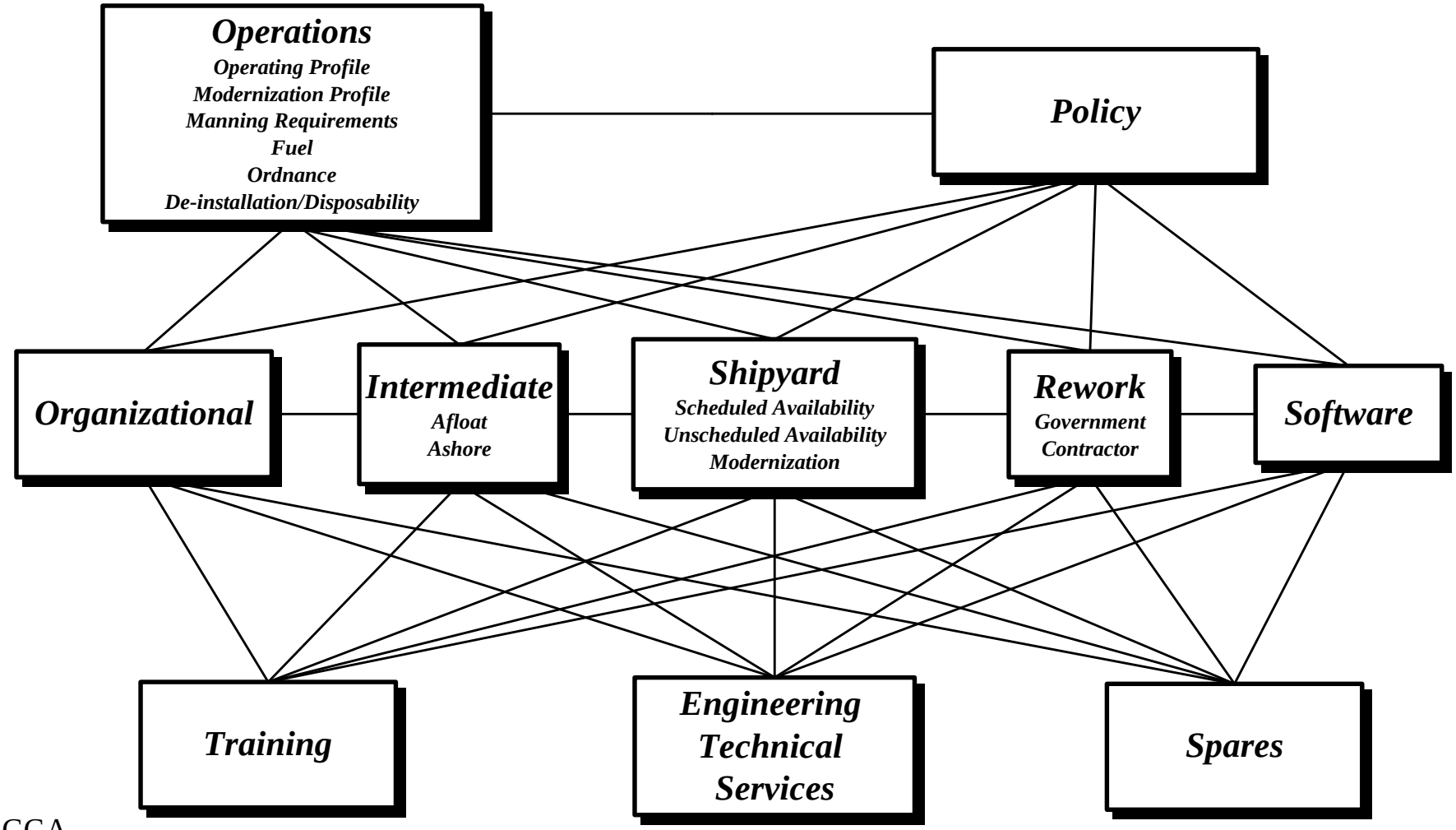
- Model Overview
- Model Description
- Strengths
- Limitations
- Ongoing Efforts
- Screen Shots

Model Overview

- Standardized, yet flexible approach to estimating / analyzing O&S costs and availability
  - OSCAM(Sys) for new and in-service ship systems
  - OSCAM(Ship) for new and in-service ships
- Developed jointly by NCCA, UK MoD and HVR Consulting Services Ltd

Model Description

Model Sectors



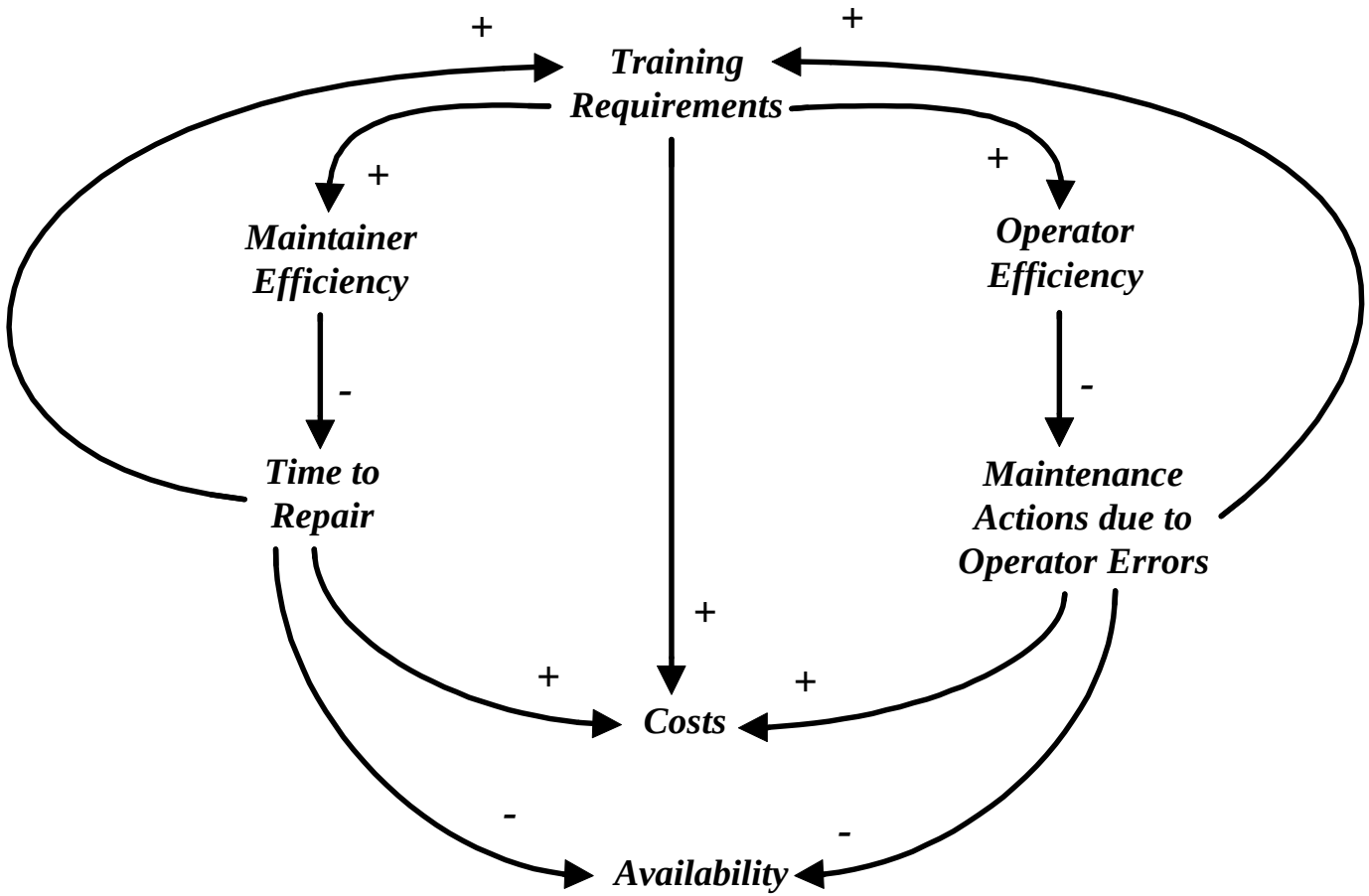
Model Description

System Dynamics

- Captures the dynamic behavior of a system
- Facilitates the analysis of change
- Allows modeling of complex systems with interacting components
- Allows for rapid prototyping
- Provides a structured methodology
- Allows for a flexible design

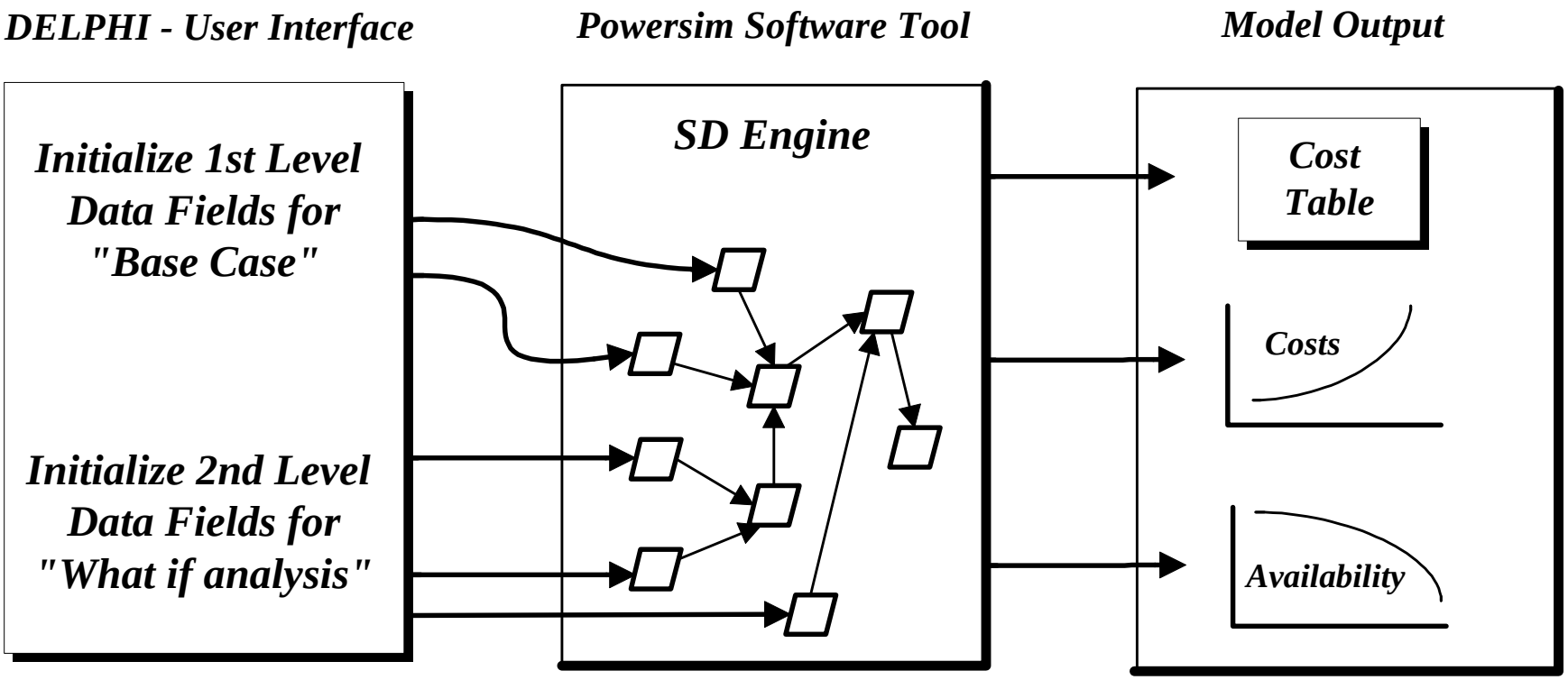
Model Description

Example Influence Diagram



Model Description

Architecture Overview



Model Description

Two Levels of Simulation/Analysis

- OSCAM was designed to be used at two levels of detail
- ***First level*** simulation maximizes use of historical data
- ***Second level*** simulation makes use of system dynamics and allows users to evaluate the sensitivity related to cost and availability with respect to alternative O&S policies

Model Description

OSCAM(Sys) First Level Data

System Characteristics
- System Production Cost
- System Installation Cost
- System Weight

Manning
- Operators per System
- Maintainers per System
- Annual Operator Labor Rate
- Annual Maintainer Labor Rate

Fuel
- Fuel Cost per System per Year

Ordnance
- Ordnance Cost per System per Year

Disposal
- De-Installation Factor
- Disposal Cost per lb

O/I-Level Maintenance
- Unscheduled/Scheduled/Alteration Actions
  - Actions per System per Year
  - Manhours per Action
  - Repair Parts per Action
  - Cost per Repair Part
  - Repairables per Action
  - Average Exchange Cost
  - Average Issue Cost
  - % of Exchanges

I-Level Maintenance Labor
- Hourly Labor Rate
  - Direct Rate
  - Overhead Factor

Shipyard Repair
- Shipyard Cost per System per Year

Depot/Rework
- Contractor Depot Cost per System per Year
- Other Depot Cost per System per Year

Modernization
- CPM per System per Year
- Installation Cost per System per Year

Software
- Software Maintenance Cost per Year

Engineering Technical Services
- ETS Cost per Year

Training
- Student-Days per System per Year
- Cost per Student-Day
  - Instructor Cost
  - Facilities Cost

Model Description

OSCAM(Ship) First Level Data

Primary Data Set

- ***Ship Characteristics***
  - Weight (Full Load Displacement FLD)
- ***Steaming Characteristics***
  - SHU In Fleet Time
  - NU External Power In Fleet Time
- ***Support Services***
  - Variable At Sea Support Services Cost
  - Fixed At Sea Support Services Cost
  - Variable Alongside Support Services Cost
  - Fixed Alongside Support Services Cost
  - Variable Routine Trials Cost
  - Fixed Routine Trials Cost
- ***Manning***
  - Enlisted Crew per Ship
  - Officer Crew per Ship
  - Enlisted Pay Rate
  - Officer Pay Rate
  - Temporary Additional Duty Cost
- ***Fuel***
  - Bbls Fuel per SHU
  - Bbls Fuel per NU Own Power
  - Bbls Fuel per NU External Power
  - Cost per Bbl Fuel
  - Other POL Cost
- ***General Stores/Supplies***
  - General Stores/Supplies Cost
  - Publications Cost
- ***Ordnance***
  - Expendables Cost
  - Handling Cost
- ***O-Level, I-Level Ashore/Afloat Maintenance Unscheduled/Scheduled/Alteration Actions***
  - Actions per Ship per Year
  - Manhours per Action
  - Repair Parts per Action
  - Cost per Repair Part
  - Repairables per Action
  - Average Exchange Cost
  - Average Issue Cost
  - % of Exchanges
- ***I-Level Contractor Support Cost per Ship per Year***
- ***I-Level Ashore, Afloat Maintenance Labor***
  - Direct Rate
  - Overhead Factor
- ***Other Depot Maintenance***
  - Other Gov Depot Cost per Ship per Year
  - Contractor Depot Cost per Ship per Year
- ***Unscheduled Repair***
  - ***Type A, B Repairs***
    - Repairs per Ship per Year
    - Repair Cost per Repair
    - Average Duration of Repair
- ***Software***
  - Software Maintenance Cost
- ***Engineering Technical Services***
  - ETS Cost
- ***Training***
  - ***Enlisted, Officer Training***
    - Student-Days per Year
    - Direct Cost per Student-Day
    - Indirect Cost per Student-Day
- ***Disposal***
  - Disposal Cost per Long Ton

Model Description

OSCAM(Ship) First Level Data (cont.)

Operating Profile Data Set	***Scheduled Overhaul Data Set***	
Ship Life	***Miscellaneous Services***	***Scheduled Overhaul Attributes***
Overhaul Profiles	Design & Planning Services Cost	***Types 1-5***
Up to 30 Entries	Other Modernization Services Cost	Overhaul Type
Overhaul Type	Outfitting and Spares Factor	Planned Duration
Start Time	***Labor Rates***	Strike Rate (Person-months/month)
CPM Factor	Refueling Labor Rate	CPM Cost
Extended Readiness Profile	Update/Modernize Labor Rate	Update/Modernize Person-Month Factor
Introduction	Upkeep/Repair Labor Rate	Update/Modernize Material Cost Factor
Duration		Refuel Replacement Core Cost
		Refuel Person-Months
		Refuel Material Cost Factor
		Upkeep/Repair Person-Months
		Upkeep/Repair Material Cost Factor
		Post Trials Duration
		Post Trials Cost
		During Overhaul Enlisted Factor
		Post Overhaul Enlisted Factor
		During Overhaul Officer Factor
		Post Overhaul Officer Factor
		O/I-Level Actions Factor
		Age Reduction
		O-Level Maintainer Efficiency Factor

Model Description

Second Level Analyses (OSCAM(Ship) Examples)

Manning Level Impacts on Maintenance/Availabilty

OPTEMPO Impact on Fuel Consumption

OPTEMPO Impact on Steaming Hours Underway

OPTEMPO Impact on Maintenance Requirements

Age Impact on Steaming Hours Underway

Age Impact on Fuel Consumption

Age Impact on Maintenance Requirements

Hull Cleaning Impact on Fuel Consumption

Rate of Firing Impacts

Rate of Handling Operations Impacts

Logistics Delay Impacts on Availability

Maintenance Requirement Impacts on Unscheduled Repairs/Availability

Midlife Overhaul Impacts on Engineering Technical Services

Training Requirements Impact on Maintenance/Availability

Scheduled Overhaul Cycle Impacts on Shipyard Capacity

Scheduled Overhaul Impacts on Ship Age

Scheduled Overhaul Requirement Impacts on O/I-Level Maintenance

Model Description

OSCAM(Sys) Historical Data Sets

EDTS(2)	EWS(2)	FCS(8)	Radars(7)	Sonars(5)
SYS 2 IADTS	SLQ 25	**Surface Ship**	**Surface Ship**	**Surface Ship**
MK 14 WDS	SLQ 32	Harpoon WS	**Surface Search**	SQS 53
		MK 74 FCS	SPS 55	SQS 56
Radio(1)	**Guns(2)**	MK 86 GFCS	SPS 64	**Combat Systems**
BRD 7	MK 42	MK 92 FCS	SPS 67	SQQ 89
	MK 45	MK 16 ASROC	**Air Search**	BQQ 5
		MK 15 CIWS	SPS 40	BSY 1
Missile Launchers(2)	**Engine(1)**	**Submarine**	SPS 48 C&E	
MK 26 GMLS	LM 2500 Engine	MK 1	SPS 49	
MK 41 VLS		MK 117	**Submarine**	
			BPS 15	

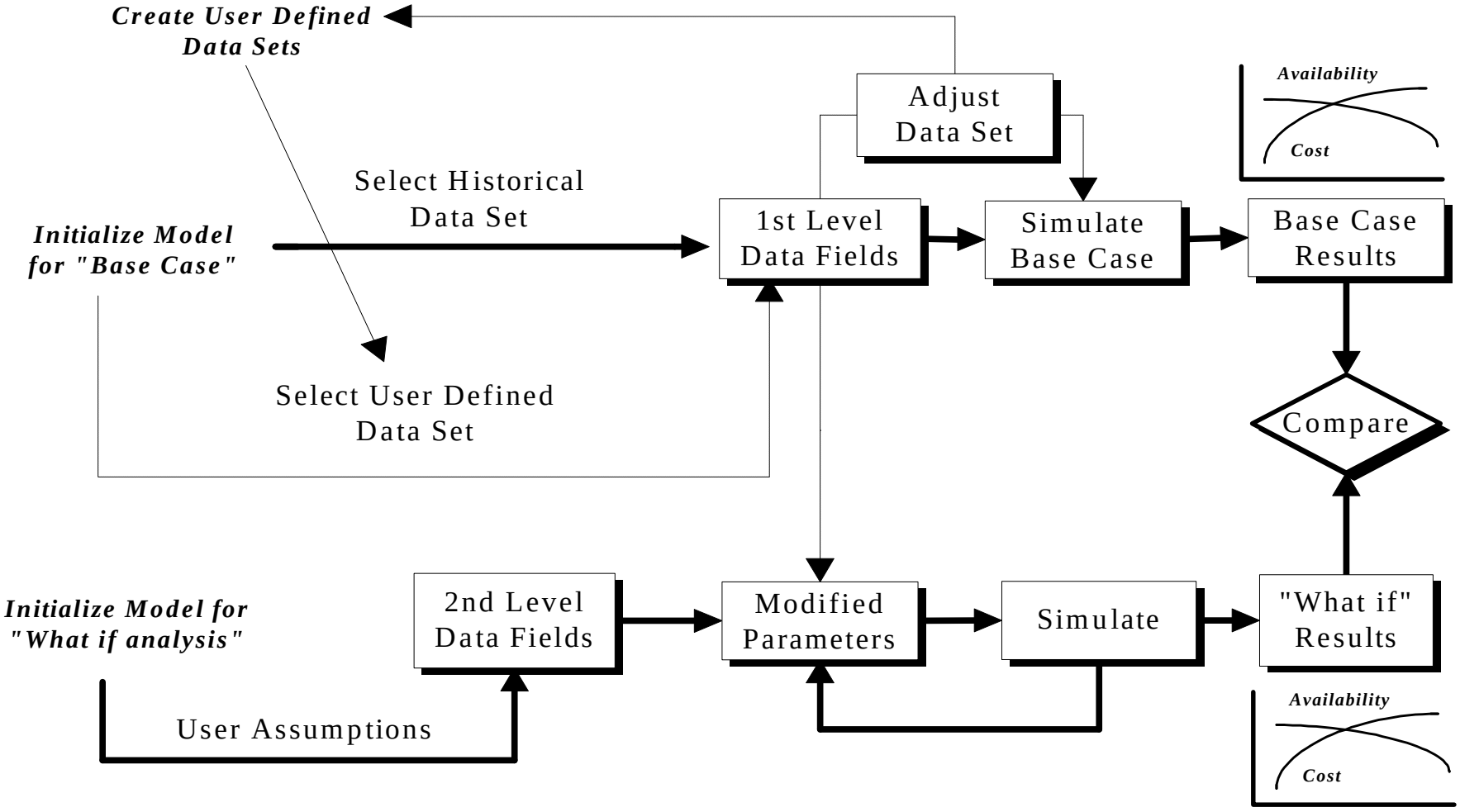
Model Description

OSCAM(Ship) Historical Data Sets

Carriers(8)	Combatants(20)	Submarines(21)	Support(29)	Mine Warfare(3)
AVT-16CL	BB-61CL	AGSS-555CL	AD-14CL	MCM-1CL
AVT-59CL	CG-16CL	SS-576CL	AD-37CL	MHC-51CL
CV-41CL	CG-26CL	SS-580CL	AD-41CL	MSO-422CL
CV-59CL	CG-47CL	SSBN-598CL	AE-21CL	
CV-63CL	CGN-09CL	SSBN-616CL	AE-23CL	**Patrol(2)**
CV-67CL	CGN-25CL	SSBN-627CL	AE-26CL	PC-1CL
CVN-65CL	CGN-35CL	SSBN-640CL	AFS-1CL	PHM-1CL
CVN-68CL	CGN-36CL	SSBN-726CL	AGDS-2CL	
	CGN-38CL	SSN-575CL	AO-177CL	
Amphibs(14)	DD-963CL	SSN-578CL	AO-51CL	
AGF-03CL	DDG-2CL	SSN-585CL	AOE-1CL	
AGF-11CL	DDG-37CL	SSN-594CL	AOE-6CL	
LCC-19CL	DDG-51CL	SSN-597CL	AOR-1CL	
LHA-1CL	DDG-993CL	SSN-608CL	AR-05CL	
LHD-1CL	FF-1037CL	SSN-637CL	ARL-1CL	
LKA-113CL	FF-1040CL	SSN-640CL	ARS-38CL	
LPD-1CL	FF-1052CL	SSN-671CL	ARS-50CL	
LPD-4CL	FF-1098CL	SSN-685CL	ARS-6CL	
LPH-2CL	FFG-1CL	SSN-688CL1	AS-11CL	
LSD-28CL	FFG-7CL	SSN-688CL2	AS-19CL	
LSD-36CL		SSN-688CL3	AS-31CL	
LSD-41CL			AS-33CL	
LSD-49CL			AS-36CL	
LST-1179CL			AS-39CL	
			ASR-07CL	
			ASR-21CL	
			ATF-148CL	
			ATS-1CL	
			AVM-1CL	

Model Description

Model Use



Strengths

- Standardized, yet flexible approach to estimating / analyzing O&S costs for new and in-service ships and ship systems
- Direct access to historical data sets
- Facilitates understanding of O&S activities and their interdependencies
- Means of identifying VAMOSC improvements and cost research requirements

Limitations

- Database
  - Does not include all shipboard systems and ships
  - No component level data in OSCAM(Sys)
  - No system level data in OSCAM(Ship)
- Cost Estimating Relationships
  - Some weight-based and production cost-based relationships in OSCAM(Sys); None in OSCAM(Ship)
  - No performance-based relationships
  - No COTS-based relationships
- Second level analyses require users to make assumptions

Ongoing Efforts

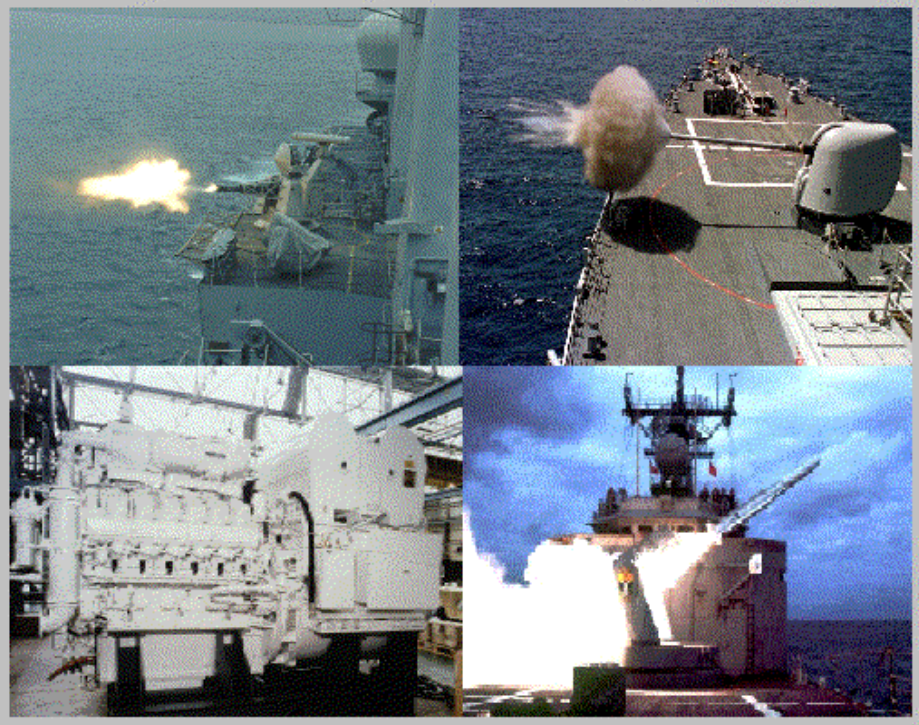
- Model Enhancements (Ver 3.0 March 1999)
  - Parametric Cost Tool (PCT)
    - Will enable users to generate user-defined data sets based on parametric CERs
  - Data Management Tool (DMT)
    - Will allow for component level analyses within OSCAM(Sys) and system level analyses within OSCAM(Ship)
- Formal Training (4 day course)
  - First two courses taught @ ACE (NCCA Funded)
  - Next offering: April/May @ ACE
- OSCAM Web Site at www.ncca.navy.mil
- OSCAM Users Group

OSCAM System V2.0 File Selection Form

File Window Help

Current Data Set Name | Programme Profile | Cost Base Year

OSCAM (Sys) Model Version 2.0



Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedule+ | Microsoft PowerPoint - ... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Shortc... | 2:17 PM

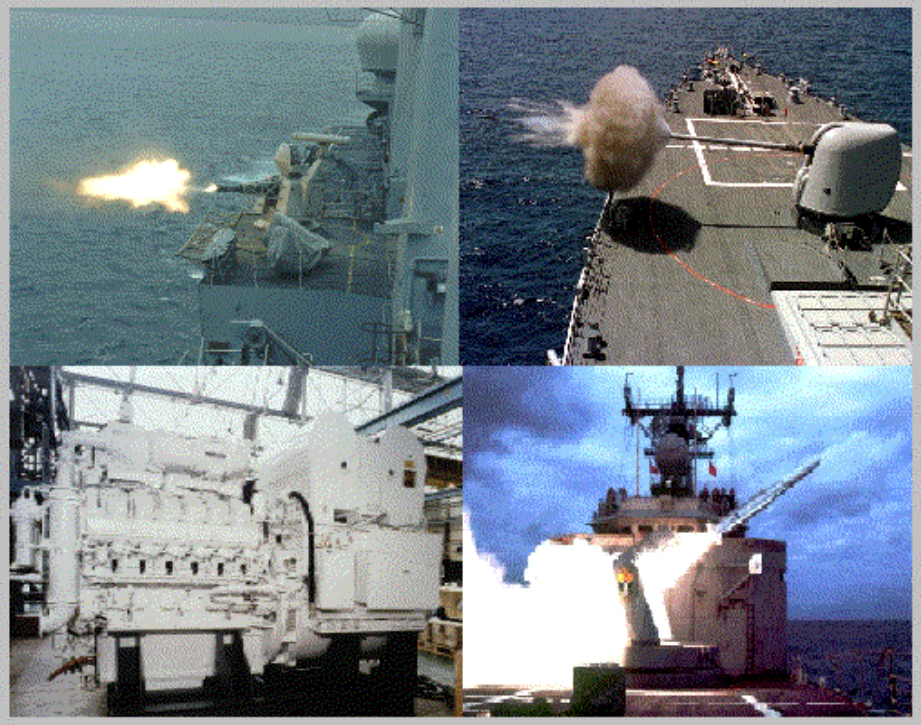
OSCAM System V2.0 File Selection Form

File Window Help

- UK / US
- Load Data Files Wizard
- Select Data Sets Wizard
- Load Individual Files and/or Data Sets
- Save Data Sets
- Save Results
- Print
- Exit

SPS 40 | Programme Profile TEMPLATE | Cost Base Year 1997

OSCAM (Sys) Model Version 2.0



Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Short... | 3:12 PM

OSCAM System V2.0 File Selection Form

File Window Help

Modify Data Set
Simulation Control
Show Results
Show Floating Tool Bar

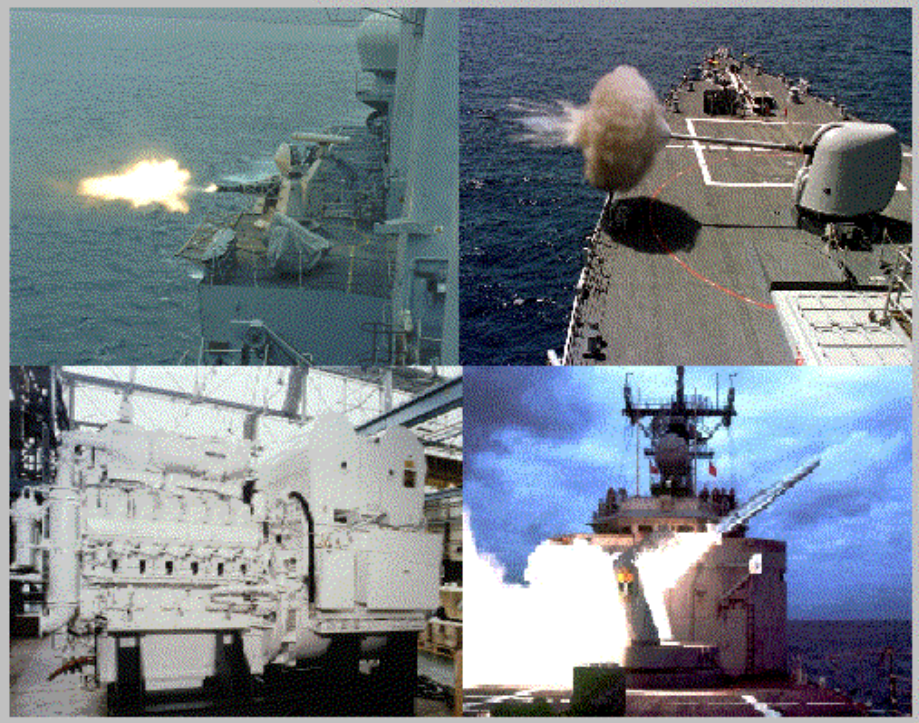
Operations Data Set
Organisational Maintenance Data Set
Intermediate Maintenance Ashore Data Set
Intermediate Maintenance Afloat Data Set
Other Sector Data Sets

Programme Profile Data Set

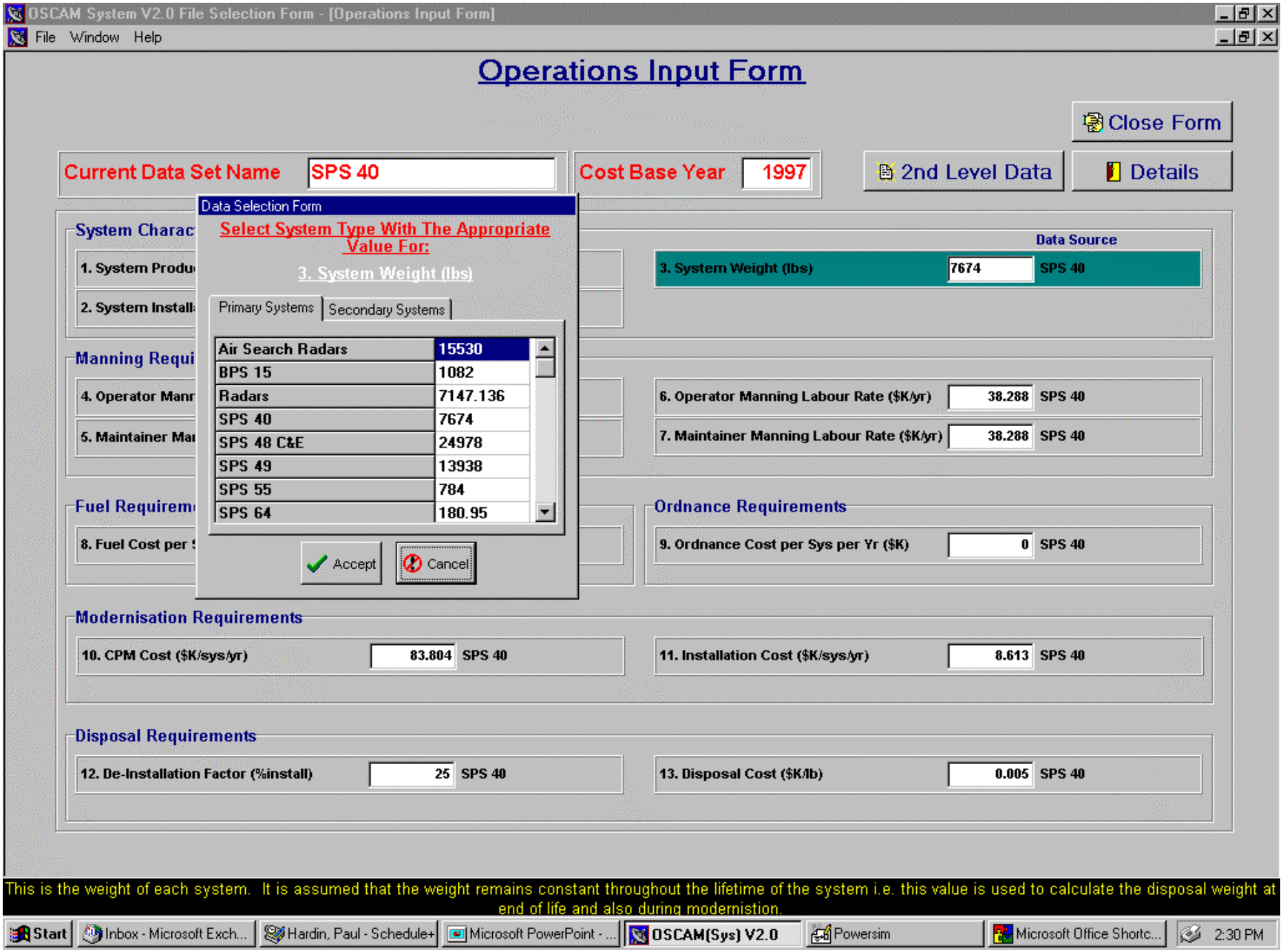
ogramme Profile TEMPLATE

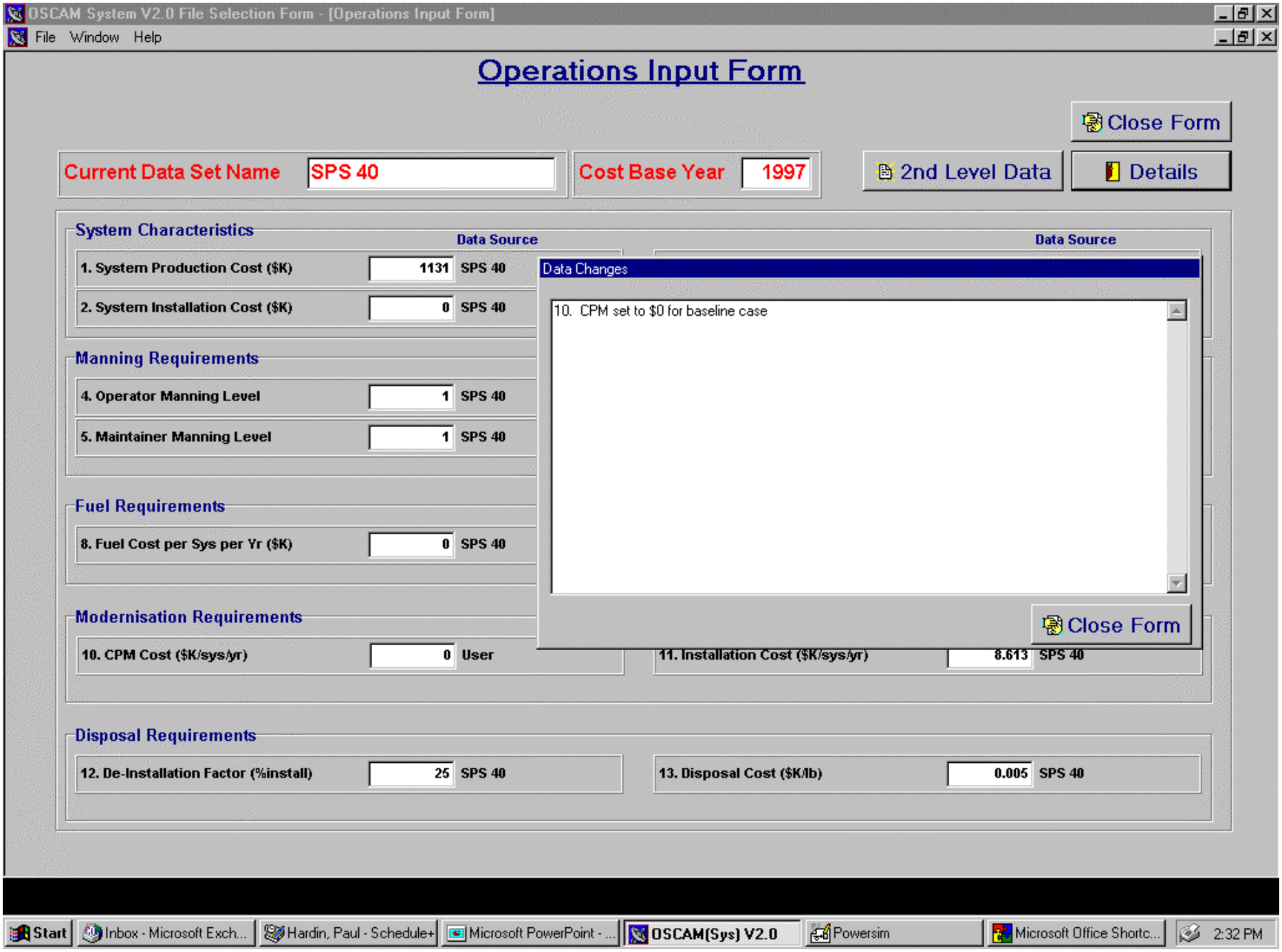
Cost Base Year 1997

ys) Model Version 2.0



Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedule+ | Microsoft PowerPoint - ... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Shortc... | 2:25 PM


OSCAM System V2.0 File Selection Form - [Operations Input Form]
File Window Help
Operations Input Form
Close Form
Current Data Set Name
SPS 40
Cost Base Year
1997
2nd Level Data
Details
Data Selection Form
Select System Type With The Appropriate Value For:
3. System Weight (lbs)
Primary Systems
Secondary Systems
Air Search Radars 15530
BPS 15 1082
Radars 7147.136
SPS 40 7674
SPS 48 C&E 24978
SPS 49 13938
SPS 55 784
SPS 64 180.95
Accept
Cancel
System Charac
1. System Produ
2. System Install
Data Source
3. System Weight (lbs) 7674 SPS 40
Manning Requi
4. Operator Manr
5. Maintainer Mai
6. Operator Manning Labour Rate ($K/yr) 38.288 SPS 40
7. Maintainer Manning Labour Rate ($K/yr) 38.288 SPS 40
Fuel Requirem
8. Fuel Cost per
Ordnance Requirements
9. Ordnance Cost per Sys per Yr ($K) 0 SPS 40
Modernisation Requirements
10. CPM Cost ($K/sys/yr) 83.804 SPS 40
11. Installation Cost ($K/sys/yr) 8.613 SPS 40
Disposal Requirements
12. De-Installation Factor (%install) 25 SPS 40
13. Disposal Cost ($K/lb) 0.005 SPS 40
This is the weight of each system. It is assumed that the weight remains constant throughout the lifetime of the system i.e. this value is used to calculate the disposal weight at end of life and also during modernistion.
Start
Inbox - Microsoft Exch...
Hardin, Paul - Schedule+
Microsoft PowerPoint - ...
OSCAM(Sys) V2.0
Powersim
Microsoft Office Shortc...
2:30 PM


OSCAM System V2.0 File Selection Form - [Operations Input Form]
File Window Help
Operations Input Form
Close Form
Current Data Set Name
SPS 40
Cost Base Year
1997
2nd Level Data
Details
System Characteristics
Data Source
1. System Production Cost ($K)
1131
SPS 40
2. System Installation Cost ($K)
0
SPS 40
Manning Requirements
4. Operator Manning Level
1
SPS 40
5. Maintainer Manning Level
1
SPS 40
Fuel Requirements
8. Fuel Cost per Sys per Yr ($K)
0
SPS 40
Modernisation Requirements
10. CPM Cost ($K/sys/yr)
0
User
Disposal Requirements
12. De-Installation Factor (%install)
25
SPS 40
Data Source
Data Changes
10. CPM set to $0 for baseline case
Close Form
11. Installation Cost ($K/sys/yr)
8.613
SPS 40
13. Disposal Cost ($K/lb)
0.005
SPS 40
Start
Inbox - Microsoft Exch...
Hardin, Paul - Schedule+
Microsoft PowerPoint - ...
OSCAM(Sys) V2.0
Powersim
Microsoft Office Shortc...
2:32 PM

OSCAM System V2.0 File Selection Form

File Window Help

Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

OSCAM (Sys) Model Version 2.0

Simulation Control Tool Bar

Simulation Duration (Years) 40

Current Year 20

RUNNING

Progress 50%

PowerSim Model : OSCSysV2.sim

2nd Level Data Selection :

- Fuel
- Ordnance
- Modernisation
- Manning
- Consumables
- Shipyard
- Other Depot/Contractor
- Software
- Engineering Technical Services
- Training
- I/O Maintenance Actions
- I/O Maintenance Labour
- Spares Management

Play (Start the simulation)

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedule+ | Microsoft PowerPoint - ... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Shortc... | 2:36 PM

OSCAM System V2.0 File Selection Form - [Results Display Form]

File Window Help

Current Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

Print Graph | Configure Table | Delete Results | Close Form

Year Ending	0	1	2		8
1 Operating Systems (Systems)	0.000	0.889	1.000	0	1.000
2 Operations Costs ($K)	0.000	29.780	75.512	76	76.576
3 Manning Costs ($K)	0.000	29.780	75.512	76	76.576
4 Consumables Costs (Other Stores - 2nd Level O/P) ($K)	0.000	0.000	0.000	0	0.000
5 Fuel Costs ($K)	0.000	0.000	0.000	0	0.000
6 Ordnance Costs ($K)	0.000	0.000	0.000	0	0.000
7 Disposal Costs ($K)	0.000	0.000	0.000	0	0.000
8 Maintenance Costs ($K)	0.000	17.944	45.500	41	46.141
9 O-Level Costs ($K)	0.000	1.217	3.085	9	3.129
10 O-Level Repair Parts Costs ($K)	0.000	1.217	3.085	9	3.129

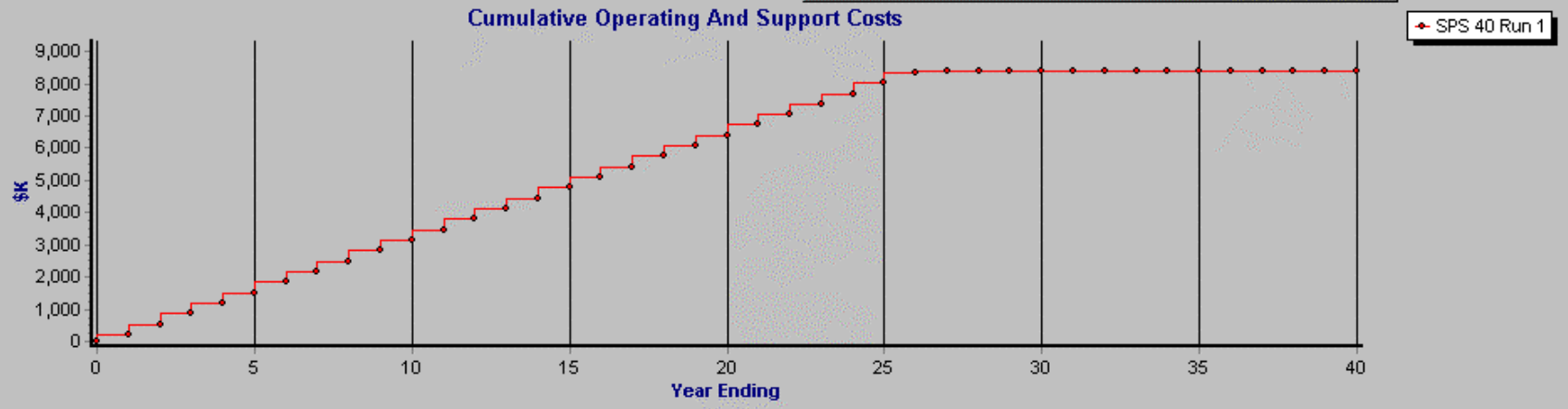
Change Outputs Table Display Form

List of Outputs to Display in the Table :

- [x] 1 Operating Systems
- [x] 2 Operations Costs
- [x] 3 Manning Costs
- [x] 4 Consumables Costs (Other Stores - 2nd Level O/P)
- [x] 5 Fuel Costs
- [x] 6 Ordnance Costs
- [x] 7 Disposal Costs
- [x] 8 Maintenance Costs
- [x] 9 O-Level Costs
- [x] 10 O-Level Repair Parts Costs
- [x] 11 I-Level (Ashore) Costs
- [x] 12 I-Level (Ashore) Labor Costs
- [x] 13 I-Level (Ashore) Repair Parts Costs

Close Form

SPS 40 Run 1



Reconfigure the outputs displayed in the table

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedule+ | Microsoft PowerPoint - ... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Shortc... | 2:39 PM

OSCAM System V2.0 File Selection Form - [Results Display Form]

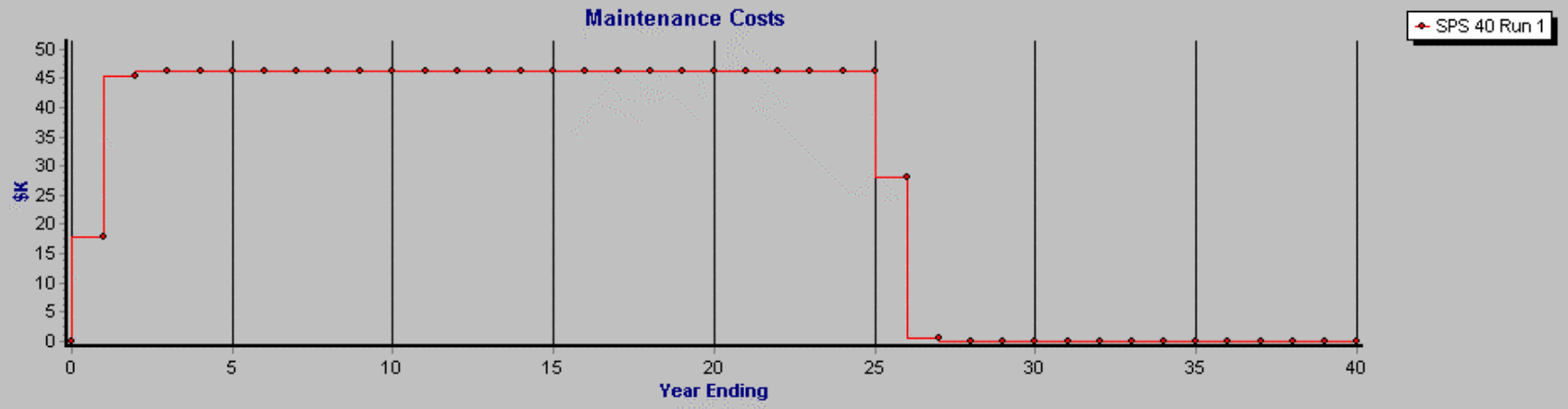
File Window Help

Current Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

Print Graph | Configure Table | Delete Results | Close Form

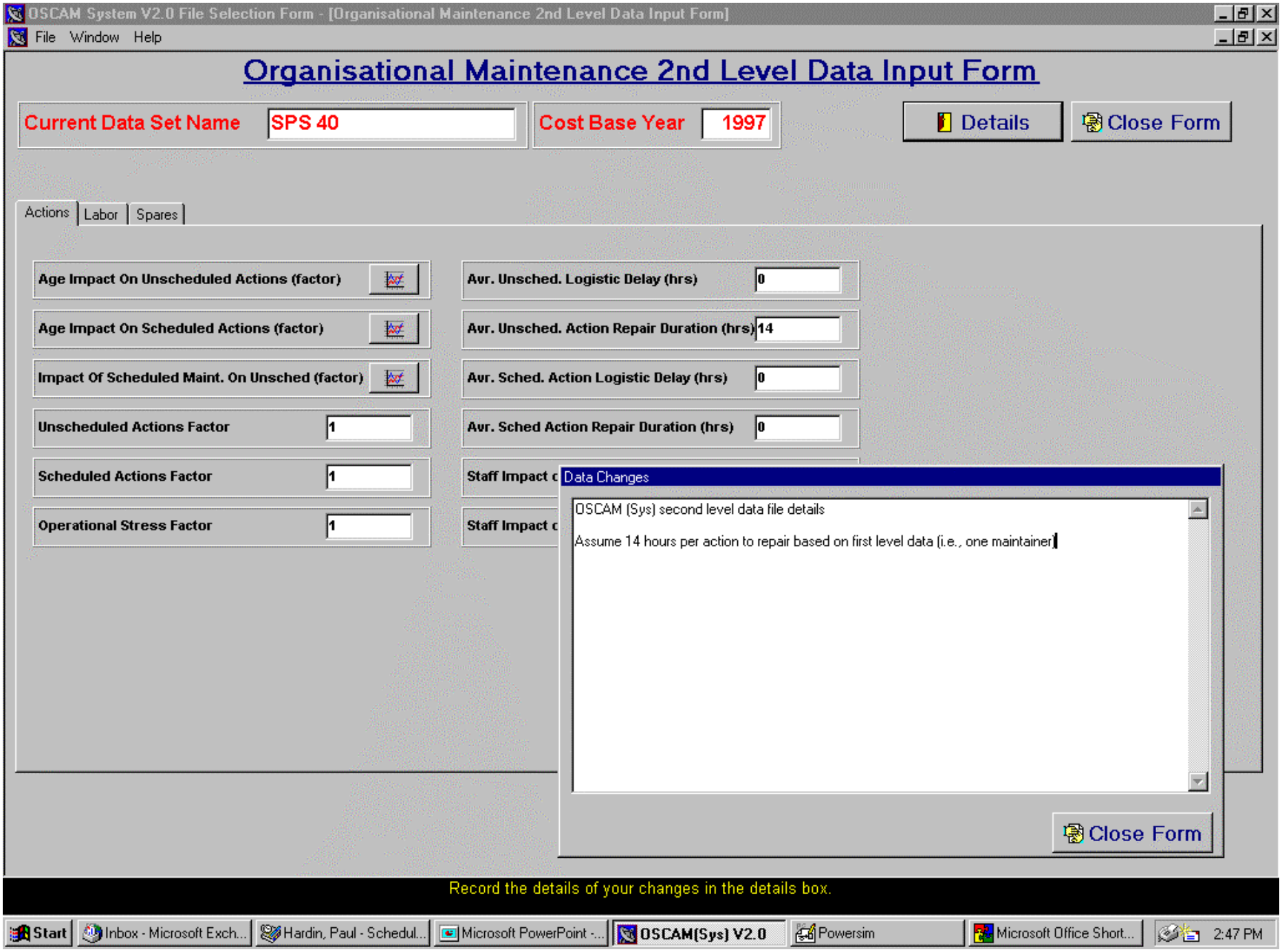
Year Ending	0	1	2	3	4	5	6	7	8
1 Operating Systems (Systems)	0.000	0.889	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2 Operations Costs ($K)	0.000	29.780	75.512	76.576	76.576	76.576	76.576	76.576	76.576
3 Manning Costs ($K)	0.000	29.780	75.512	76.576	76.576	76.576	76.576	76.576	76.576
4 Consumables Costs (Other Stores - 2nd Level O/P) ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 Fuel Costs ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 Ordnance Costs ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7 Disposal Costs ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8 Maintenance Costs ($K)	0.000	17.944	45.500	46.141	46.141	46.141	46.141	46.141	46.141
9 O-Level Costs ($K)	0.000	1.217	3.085	3.129	3.129	3.129	3.129	3.129	3.129
10 O-Level Repair Parts Costs ($K)	0.000	1.217	3.085	3.129	3.129	3.129	3.129	3.129	3.129

SPS 40 Run 1



This is the results table for each run. Double click a row (not the left most column) to show that data in the graph.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedule+ | Microsoft PowerPoint - ... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Shortc... | 2:40 PM


OSCAM System V2.0 File Selection Form - [Organisational Maintenance 2nd Level Data Input Form]
File Window Help
Organisational Maintenance 2nd Level Data Input Form
Current Data Set Name
SPS 40
Cost Base Year
1997
Details
Close Form
Actions
Labor
Spares
Age Impact On Unscheduled Actions (factor)
Age Impact On Scheduled Actions (factor)
Impact Of Scheduled Maint. On Unsched (factor)
Unscheduled Actions Factor
1
Scheduled Actions Factor
1
Operational Stress Factor
1
Avr. Unsched. Logistic Delay (hrs)
0
Avr. Unsched. Action Repair Duration (hrs)
14
Avr. Sched. Action Logistic Delay (hrs)
0
Avr. Sched Action Repair Duration (hrs)
0
Staff Impact c
Staff Impact c
Data Changes
OSCAM (Sys) second level data file details
Assume 14 hours per action to repair based on first level data (i.e., one maintainer
Close Form
Record the details of your changes in the details box.
Start
Inbox - Microsoft Exch...
Hardin, Paul - Schedul...
Microsoft PowerPoint -...
OSCAM(Sys) V2.0
Powersim
Microsoft Office Short...
2:47 PM

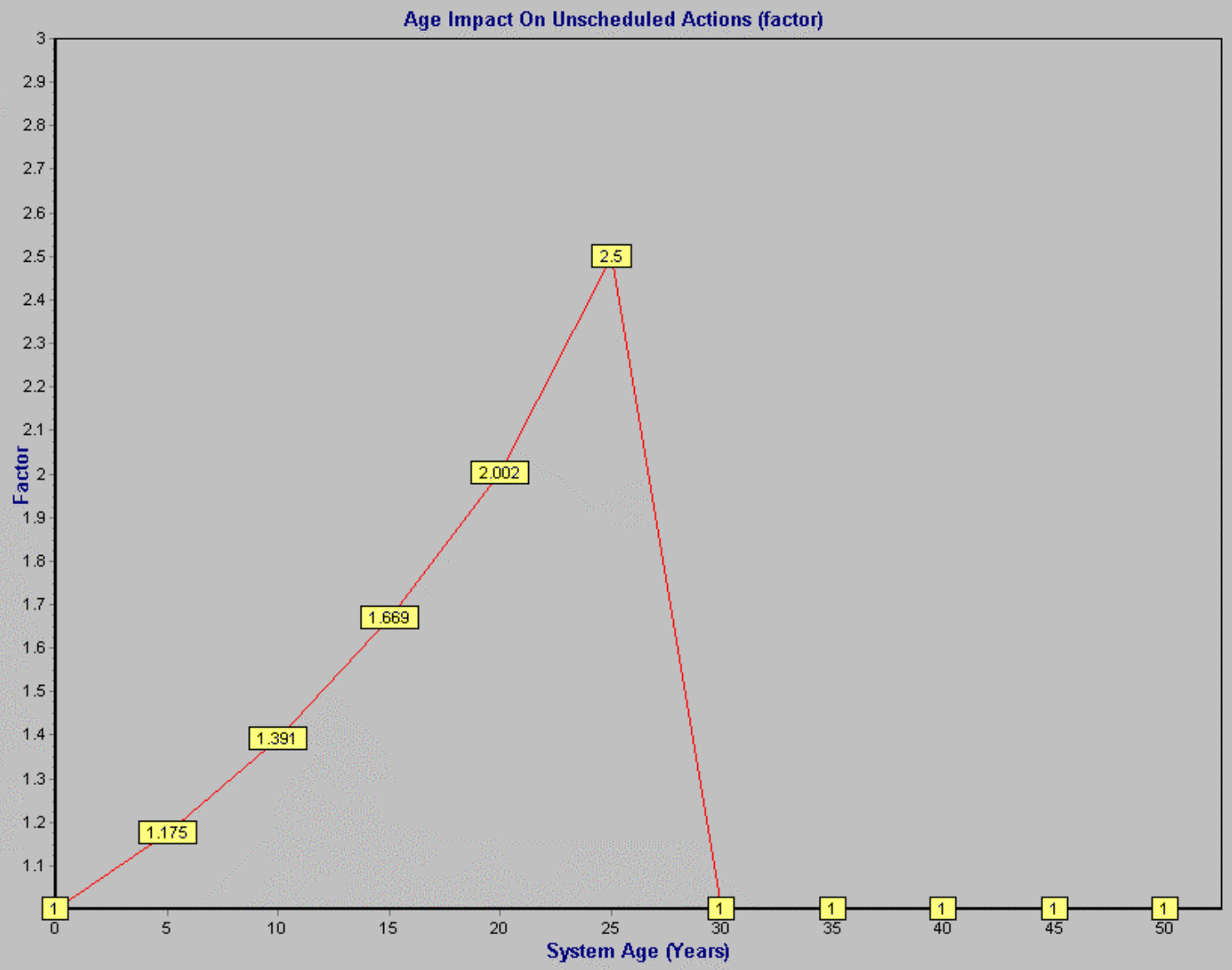
2nd Level Graph Input

X values	Y values
0.000	1.000
5.000	1.175
10.000	1.391
15.000	1.669
20.000	2.002
25.000	2.5
30.000	1.000
35.000	1.000
40.000	1.000
45.000	1.000
50.000	1.000

Rescale

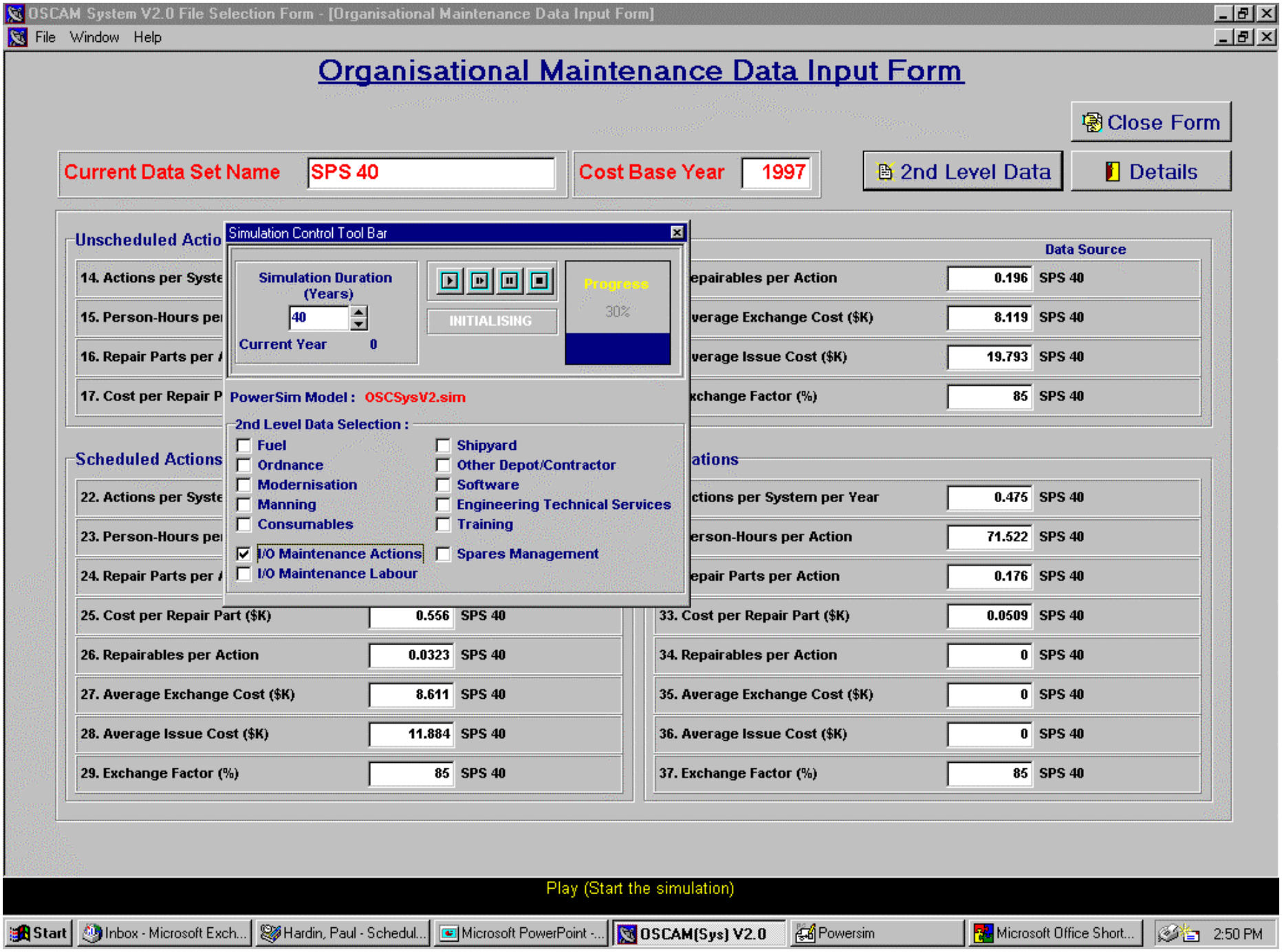
The impact of system age on the rate of unscheduled maintenance actions. The change are represented as a factor of the base case rate of actions.

Accept Cancel



Pan Up and Down using Right mouse button, hold down the SHIFT key and move the cursor with the mouse to reshape the graph.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Short... | 2:44 PM


OSCAM System V2.0 File Selection Form - [Organisational Maintenance Data Input Form]
File Window Help
Organisational Maintenance Data Input Form
Close Form
Current Data Set Name
SPS 40
Cost Base Year
1997
2nd Level Data
Details
Simulation Control Tool Bar
Simulation Duration (Years)
40
Current Year 0
INITIALISING
Progress
30%
PowerSim Model : OSCSysV2.sim
2nd Level Data Selection :
Fuel
Ordnance
Modernisation
Manning
Consumables
Shipyard
Other Depot/Contractor
Software
Engineering Technical Services
Training
I/O Maintenance Actions
I/O Maintenance Labour
Spares Management
Unscheduled Actio
Scheduled Actions
Data Source
14. Actions per Syste
15. Person-Hours pe
16. Repair Parts per
17. Cost per Repair P
epairables per Action 0.196 SPS 40
verage Exchange Cost ($K) 8.119 SPS 40
verage Issue Cost ($K) 19.793 SPS 40
xchange Factor (%) 85 SPS 40
ations
22. Actions per Syste
23. Person-Hours pe
24. Repair Parts per
25. Cost per Repair Part ($K) 0.556 SPS 40
26. Repairables per Action 0.0323 SPS 40
27. Average Exchange Cost ($K) 8.611 SPS 40
28. Average Issue Cost ($K) 11.884 SPS 40
29. Exchange Factor (%) 85 SPS 40
ctions per System per Year 0.475 SPS 40
erson-Hours per Action 71.522 SPS 40
epair Parts per Action 0.176 SPS 40
33. Cost per Repair Part ($K) 0.0509 SPS 40
34. Repairables per Action 0 SPS 40
35. Average Exchange Cost ($K) 0 SPS 40
36. Average Issue Cost ($K) 0 SPS 40
37. Exchange Factor (%) 85 SPS 40
Play (Start the simulation)
Start
Inbox - Microsoft Exch...
Hardin, Paul - Schedul...
Microsoft PowerPoint -...
OSCAM(Sys) V2.0
Powersim
Microsoft Office Short...
2:50 PM

OSCAM System V2.0 File Selection Form - [Results Display Form]

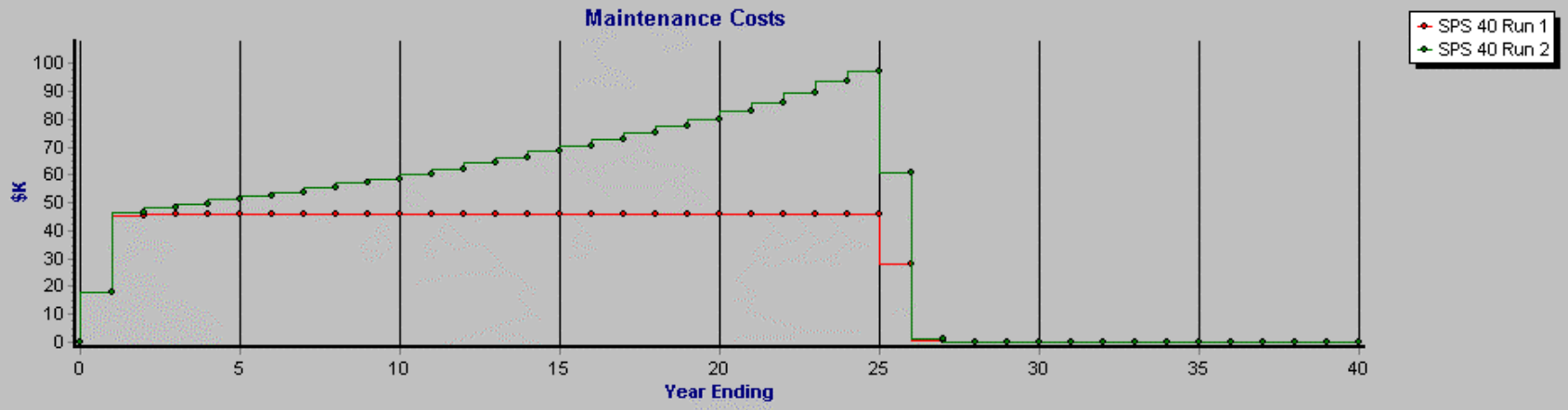
File Window Help

Current Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

Print Graph | Configure Table | Delete Results | Close Form

Year Ending	0	1	2	3	4	5	6	7	8
1 Operating Systems (Systems)	0.000	0.889	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2 Operations Costs ($K)	0.000	29.780	75.512	76.576	76.576	76.576	76.576	76.576	76.576
3 Manning Costs ($K)	0.000	29.780	75.512	76.576	76.576	76.576	76.576	76.576	76.576
4 Consumables Costs (Other Stores - 2nd Level O/P) ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
5 Fuel Costs ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
6 Ordnance Costs ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
7 Disposal Costs ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8 Maintenance Costs ($K)	0.000	18.069	46.551	48.480	49.771	51.062	52.366	53.889	55.484
9 O-Level Costs ($K)	0.000	1.227	3.174	3.327	3.436	3.545	3.655	3.784	3.919
10 O-Level Repair Parts Costs ($K)	0.000	1.227	3.174	3.327	3.436	3.545	3.655	3.784	3.919

SPS 40 Run 1 | SPS 40 Run 2



This is the results table for each run. Double click a row (not the left most column) to show that data in the graph.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Short... | 2:52 PM

OSCAM System V2.0 File Selection Form - [Results Display Form]

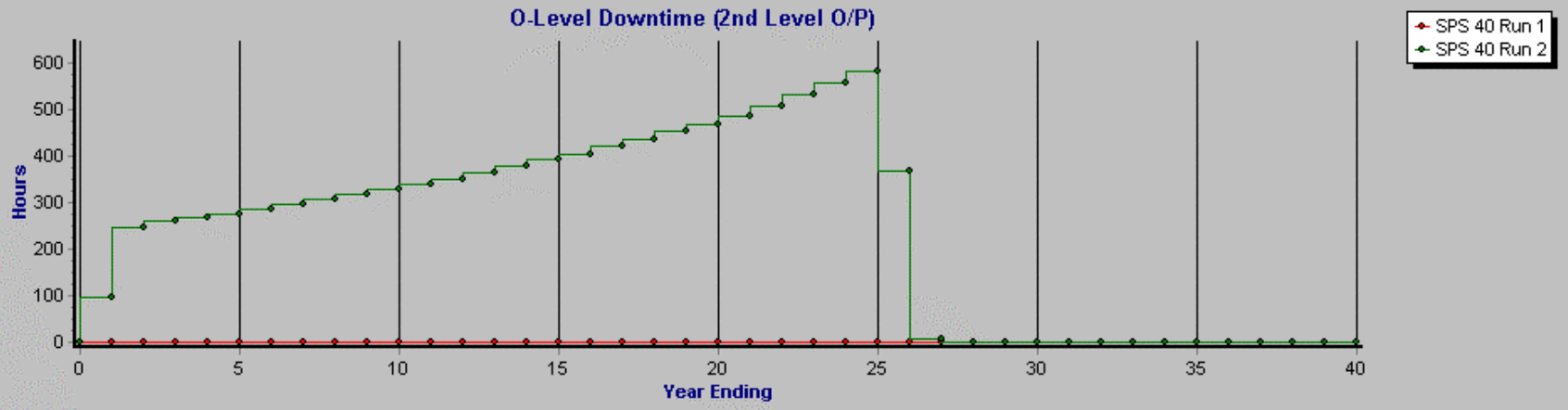
File Window Help

Current Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

Print Graph | Configure Table | Delete Results | Close Form

Year Ending	0	1	2	3	4	5	6	7	8
43 I-Level (Afloat) Person-Hours(Scheduled) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
44 I-Level (Afloat) Person-Hours(Alteration) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45 Modernization Tasks Outstanding (2nd Level O/P) (Tasks)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46 Availability (2nd Level O/P) (% downtime)	0.000	2.814	2.870	2.966	3.064	3.161	3.260	3.375	3.496
47 Total Downtime (2nd Level O/P) (Hours)	0.000	95.853	247.910	259.839	268.389	276.938	285.583	295.673	306.234
48 O-Level Downtime (2nd Level O/P) (Hours)	0.000	95.853	247.910	259.839	268.389	276.938	285.583	295.673	306.234
49 I-Level (Ashore) Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50 I-Level (Afloat) Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
51 Shipyard Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
52 Modernization Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

SPS 40 Run 1 | SPS 40 Run 2



This is the results table for each run. Double click a row (not the left most column) to show that data in the graph.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Short... | 2:54 PM

OSCAM System V2.0 File Selection Form - [Results Display Form]

File Window Help

Current Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

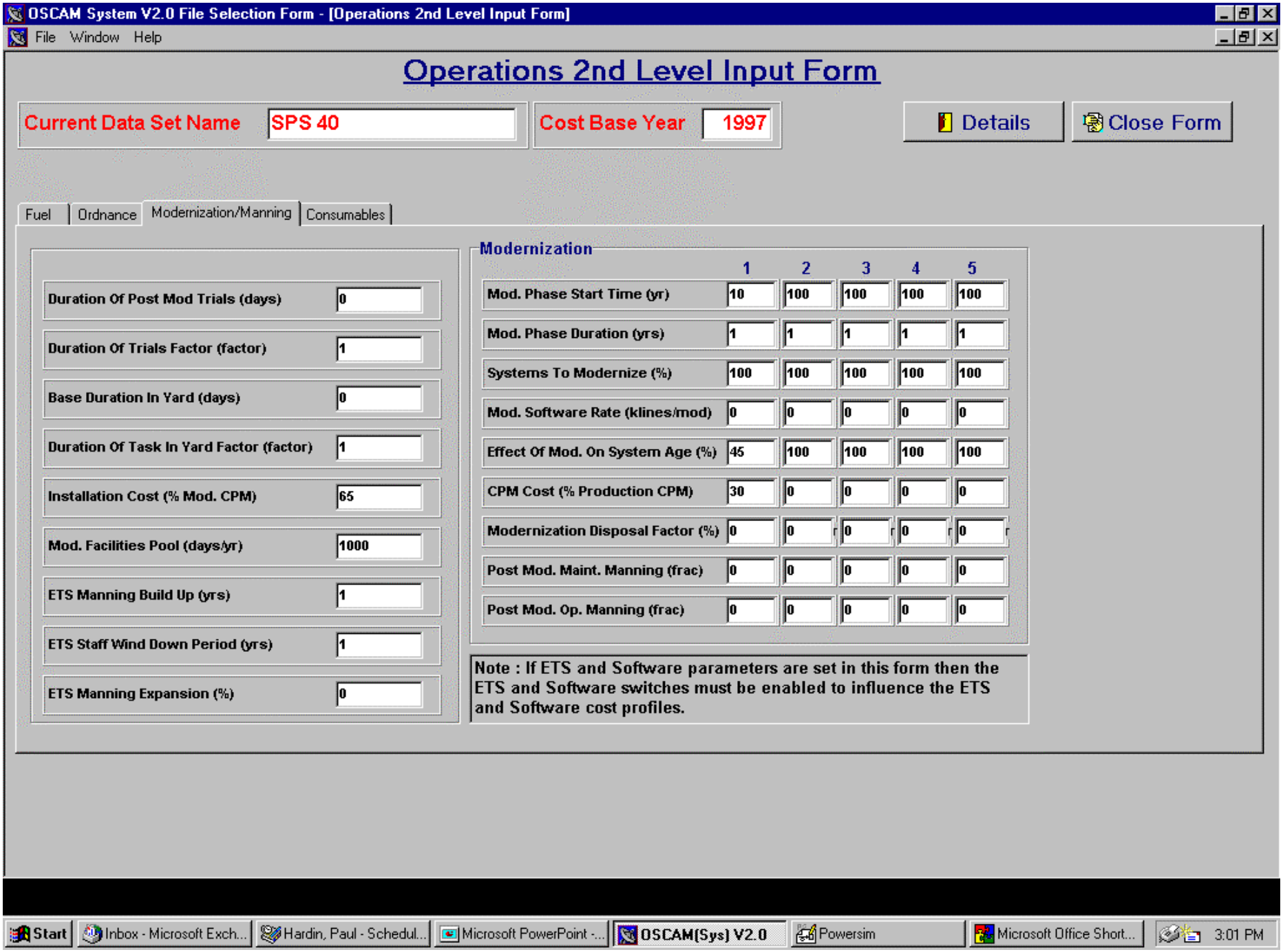
Print Graph | Configure Table | Delete Results | Close Form

Year Ending	0	1	2	3	4	5	6	7	8
43 I-Level (Afloat) Person-Hours(Scheduled) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
44 I-Level (Afloat) Person-Hours(Alteration) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45 Modernization Tasks Outstanding (2nd Level O/P) (Tasks)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46 Availability (2nd Level O/P) (% downtime)	0.000	2.814	2.870	2.966	3.064	3.161	3.260	3.375	3.496
47 Total Downtime (2nd Level O/P) (Hours)	0.000	95.853	247.910	259.839	268.389	276.938	285.583	295.673	306.234
48 O-Level Downtime (2nd Level O/P) (Hours)	0.000	95.853	247.910	259.839	268.389	276.938	285.583	295.673	306.234
49 I-Level (Ashore) Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50 I-Level (Afloat) Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
51 Shipyard Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
52 Modernization Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

SPS 40 Run 1 | SPS 40 Run 2

This is the results table for each run. Double click a row (not the left most column) to show that data in the graph.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Short... | 2:56 PM


OSCAM System V2.0 File Selection Form - [Operations 2nd Level Input Form]
File Window Help
Operations 2nd Level Input Form
Current Data Set Name
SPS 40
Cost Base Year
1997
Details
Close Form
Fuel
Ordnance
Modernization/Manning
Consumables
Duration Of Post Mod Trials (days) 0
Duration Of Trials Factor (factor) 1
Base Duration In Yard (days) 0
Duration Of Task In Yard Factor (factor) 1
Installation Cost (% Mod. CPM) 65
Mod. Facilities Pool (days/yr) 1000
ETS Manning Build Up (yrs) 1
ETS Staff Wind Down Period (yrs) 1
ETS Manning Expansion (%) 0
Modernization
1 2 3 4 5
Mod. Phase Start Time (yr) 10 100 100 100 100
Mod. Phase Duration (yrs) 1 1 1 1 1
Systems To Modernize (%) 100 100 100 100 100
Mod. Software Rate (klines/mod) 0 0 0 0 0
Effect Of Mod. On System Age (%) 45 100 100 100 100
CPM Cost (% Production CPM) 30 0 0 0 0
Modernization Disposal Factor (%) 0 0 0 0 0
Post Mod. Maint. Manning (frac) 0 0 0 0 0
Post Mod. Op. Manning (frac) 0 0 0 0 0
Note : If ETS and Software parameters are set in this form then the ETS and Software switches must be enabled to influence the ETS and Software cost profiles.
Start
Inbox - Microsoft Exch...
Hardin, Paul - Schedul...
Microsoft PowerPoint -...
OSCAM(Sys) V2.0
Powersim
Microsoft Office Short...
3:01 PM

OSCAM System V2.0 File Selection Form

File Window Help

Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

OSCAM (Sys) Model Version 2.0

Simulation Control Tool Bar

Simulation Duration (Years) 40

Current Year 13

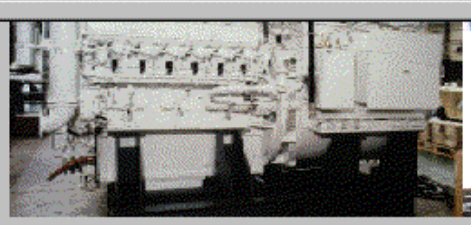
RUNNING

Progress 32%

PowerSim Model : OSCSysV2.sim

2nd Level Data Selection :

- [ ] Fuel
- [ ] Ordnance
- [x] Modernisation
- [ ] Manning
- [ ] Consumables
- [ ] Shipyard
- [ ] Other Depot/Contractor
- [ ] Software
- [ ] Engineering Technical Services
- [ ] Training
- [x] I/O Maintenance Actions
- [ ] I/O Maintenance Labour
- [ ] Spares Management



Play (Start the simulation)

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Short... | 3:04 PM

OSCAM System V2.0 File Selection Form - [Results Display Form]

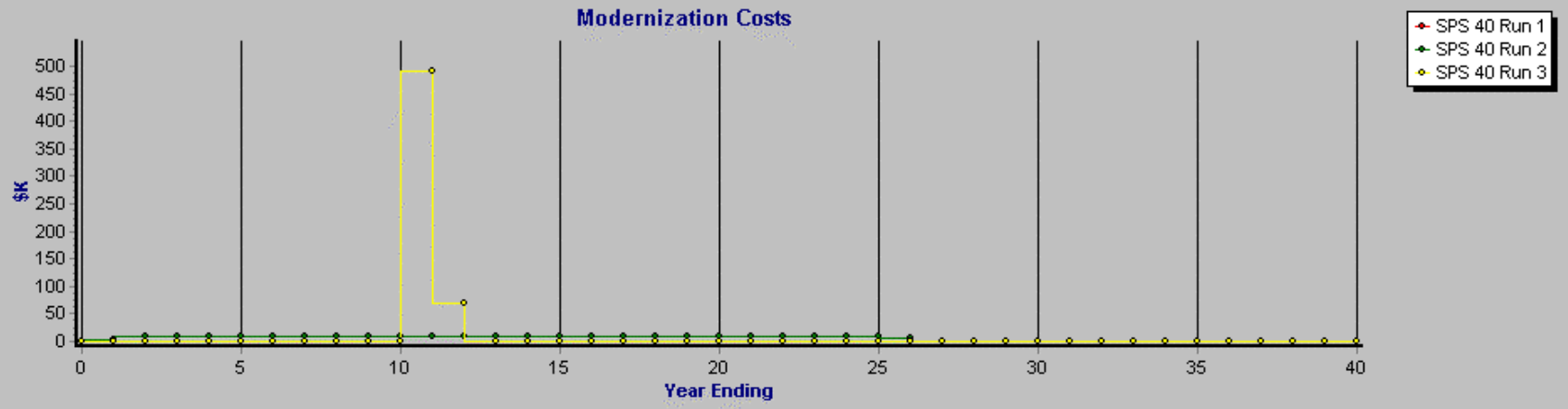
File Window Help

Current Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

Print Graph | Configure Table | Delete Results | Close Form

Year Ending	3	4	5	6	7	8	9	10	11
20 Exchanges Costs ($K)	23.634	23.634	23.634	23.634	23.634	23.634	23.634	23.634	23.634
21 Issues Costs ($K)	10.163	10.163	10.163	10.163	10.163	10.163	10.163	10.163	10.163
22 Contractor Depot Costs (4th Line) ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
23 Other Depot Costs ($K)	6.881	6.881	6.881	6.881	6.881	6.881	6.881	6.881	6.881
24 Modernization Costs ($K)	8.613	8.613	8.613	8.613	8.613	8.613	8.613	8.613	8.613
25 Centrally Provided Material Costs ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
26 Installation & Deinstallation & Disposal Costs ($K)	8.613	8.613	8.613	8.613	8.613	8.613	8.613	8.613	8.613
27 Software Maintenance Costs ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
28 Engineering Technical Services Costs ($K)	185.804	185.804	185.804	185.804	185.804	185.804	185.804	185.804	185.804
29 Training Costs ($K)	7.982	7.982	7.982	7.982	7.982	7.982	7.982	7.982	7.982

SPS 40 Run 1 | SPS 40 Run 2 | SPS 40 Run 3



This is the results table for each run. Double click a row (not the left most column) to show that data in the graph.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Short... | 3:07 PM

OSCAM System V2.0 File Selection Form - [Results Display Form]

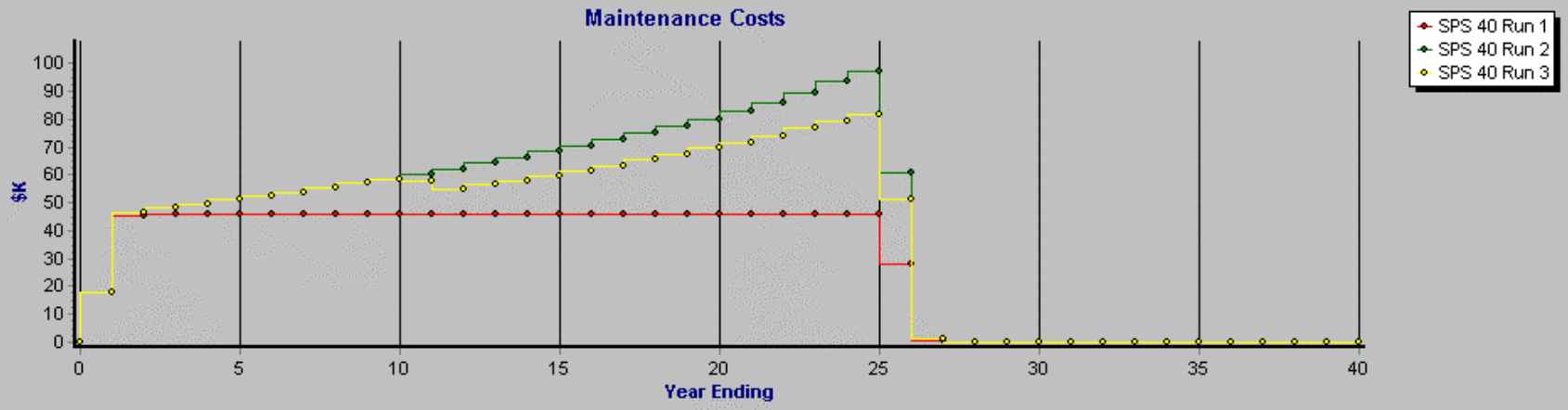
File Window Help

Current Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

Print Graph | Configure Table | Delete Results | Close Form

Year Ending	3	4	5	6	7	8	9	10	11
7 Disposal Costs ($K)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8 Maintenance Costs ($K)	46.141	46.141	46.141	46.141	46.141	46.141	46.141	46.141	46.141
9 O-Level Costs ($K)	3.129	3.129	3.129	3.129	3.129	3.129	3.129	3.129	3.129
10 O-Level Repair Parts Costs ($K)	3.129	3.129	3.129	3.129	3.129	3.129	3.129	3.129	3.129
11 I-Level (Ashore) Costs ($K)	0.173	0.173	0.173	0.173	0.173	0.173	0.173	0.173	0.173
12 I-Level (Ashore) Labor Costs ($K)	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154	0.154
13 I-Level (Ashore) Repair Parts Costs ($K)	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020	0.020
14 I-Level (Afloat) Costs ($K)	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015	0.015
15 I-Level (Afloat) Labor Costs ($K)	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011	0.011
16 I-Level (Afloat) Repair Parts Costs ($K)	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004

SPS 40 Run 1 | SPS 40 Run 2 | SPS 40 Run 3



This is the results table for each run. Double click a row (not the left most column) to show that data in the graph.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Short... | 3:08 PM

OSCAM System V2.0 File Selection Form - [Results Display Form]

File Window Help

Current Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

Print Graph | Configure Table | Delete Results | Close Form

Year Ending	3	4	5	6	7	8	9	10	11
41 Total I-Level (Afloat) Person-Hours (Hours)	0.445	0.445	0.445	0.445	0.445	0.445	0.445	0.445	0.445
42 I-Level (Afloat) Person-Hours(Unscheduled) (Hours)	0.445	0.445	0.445	0.445	0.445	0.445	0.445	0.445	0.445
43 I-Level (Afloat) Person-Hours(Scheduled) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
44 I-Level (Afloat) Person-Hours(Alteration) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
45 Modernization Tasks Outstanding (2nd Level O/P) (Tasks)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
46 Availability (2nd Level O/P) (% downtime)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
47 Total Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
48 O-Level Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
49 I-Level (Ashore) Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
50 I-Level (Afloat) Downtime (2nd Level O/P) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

SPS 40 Run 1 | SPS 40 Run 2 | SPS 40 Run 3

This is the results table for each run. Double click a row (not the left most column) to show that data in the graph.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Short... | 3:09 PM

OSCAM System V2.0 File Selection Form - [Results Display Form]

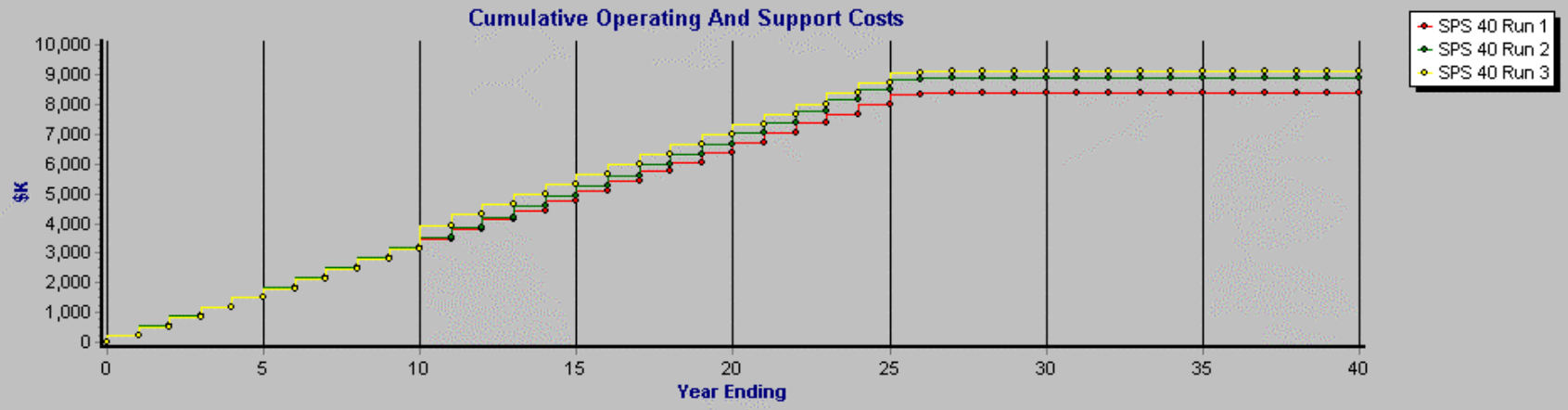
File Window Help

Current Data Set	SPS 40	Programme Profile	TEMPLATE	Cost Base Year	1997

Print Graph | Configure Table | Delete Results | Close Form

Year Ending	3	4	5	6	7	8	9	10	11
30 Total Operating & Support Costs ($K)	325.116	325.116	325.116	325.116	325.116	325.116	325.116	325.116	325.116
31 Cumulative Operating And Support Costs ($K)	865.053	1,190.169	1,515.285	1,840.401	2,165.517	2,490.633	2,815.749	3,140.865	3,465.981
32 Total Maintenance Person-Hours (Hours)	284.791	284.791	284.791	284.791	284.791	284.791	284.791	284.791	284.791
33 Total O-Level Person-Hours (Hours)	278.148	278.148	278.148	278.148	278.148	278.148	278.148	278.148	278.148
34 O-Level Person-Hours(Unscheduled) (Hours)	242.858	242.858	242.858	242.858	242.858	242.858	242.858	242.858	242.858
35 O-Level Person-Hours(Scheduled) (Hours)	1.316	1.316	1.316	1.316	1.316	1.316	1.316	1.316	1.316
36 O-Level Person-Hours(Alteration) (Hours)	33.973	33.973	33.973	33.973	33.973	33.973	33.973	33.973	33.973
37 Total I-Level (Ashore) Person-Hours (Hours)	6.199	6.199	6.199	6.199	6.199	6.199	6.199	6.199	6.199
38 I-Level (Ashore) Person-Hours(Unscheduled) (Hours)	6.195	6.195	6.195	6.195	6.195	6.195	6.195	6.195	6.195
39 I-Level (Ashore) Person-Hours(Scheduled) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

SPS 40 Run 1 | SPS 40 Run 2 | SPS 40 Run 3



This is the results table for each run. Double click a row (not the left most column) to show that data in the graph.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Sys) V2.0 | Powersim | Microsoft Office Short... | 3:10 PM

OSCAM Ship File Selection Form

File Window Help

Data Set		Programme Profile		Overhaul Types		Cost Base Year	

OSCAM (Ship) Model Version 2.0

This is the system name which will be used when the data is saved. You may amend this name at any time before saving.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedule+ | Microsoft PowerPoint - ... | OSCAM(Ship) V2.0 | Powersim - [Stock/Flo... | Microsoft Office Shortc... | 8:29 AM

OSCAM Ship File Selection Form - [Platform Lifetime and Overhaul Profile]

File Window Help

Platform Lifetime and Overhaul Profile

Data Set: SSN-688CL1 | Overhaul Profile: SSN-688CL1 | Cost Base Year: 1997

Close Form

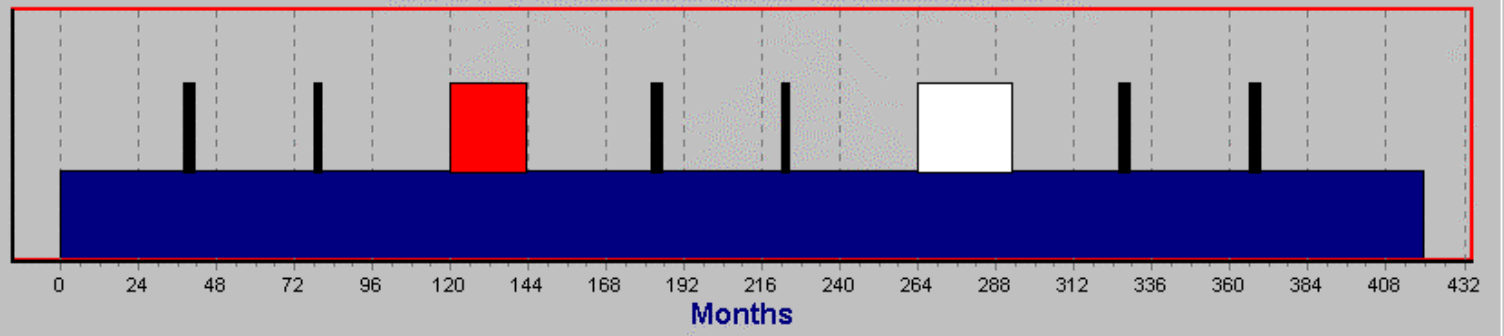
Details

OverHaul Templates

ROH	SRA	ERO	N/A	N/A

Modify Types

Platform Life Time And Overhauls Profile

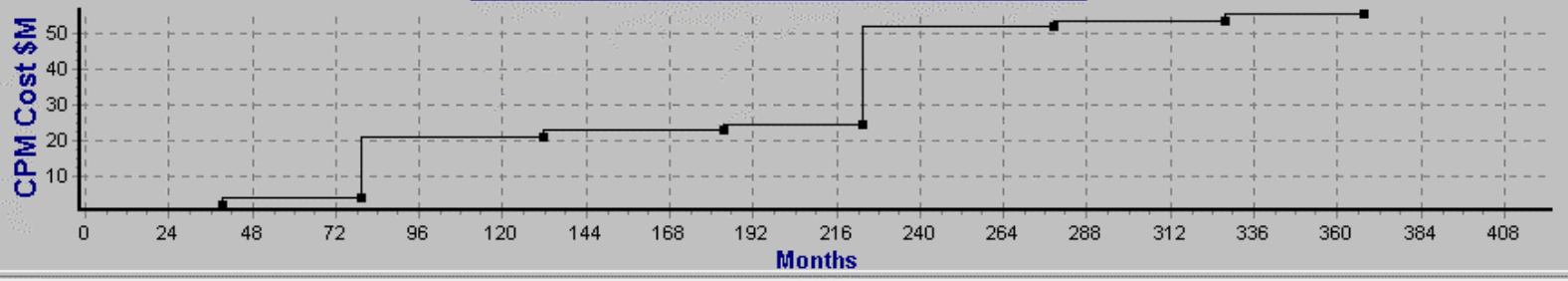


The Current Cursor Position Is: Year 7 Month 10

Month Into Ext Readiness: 999

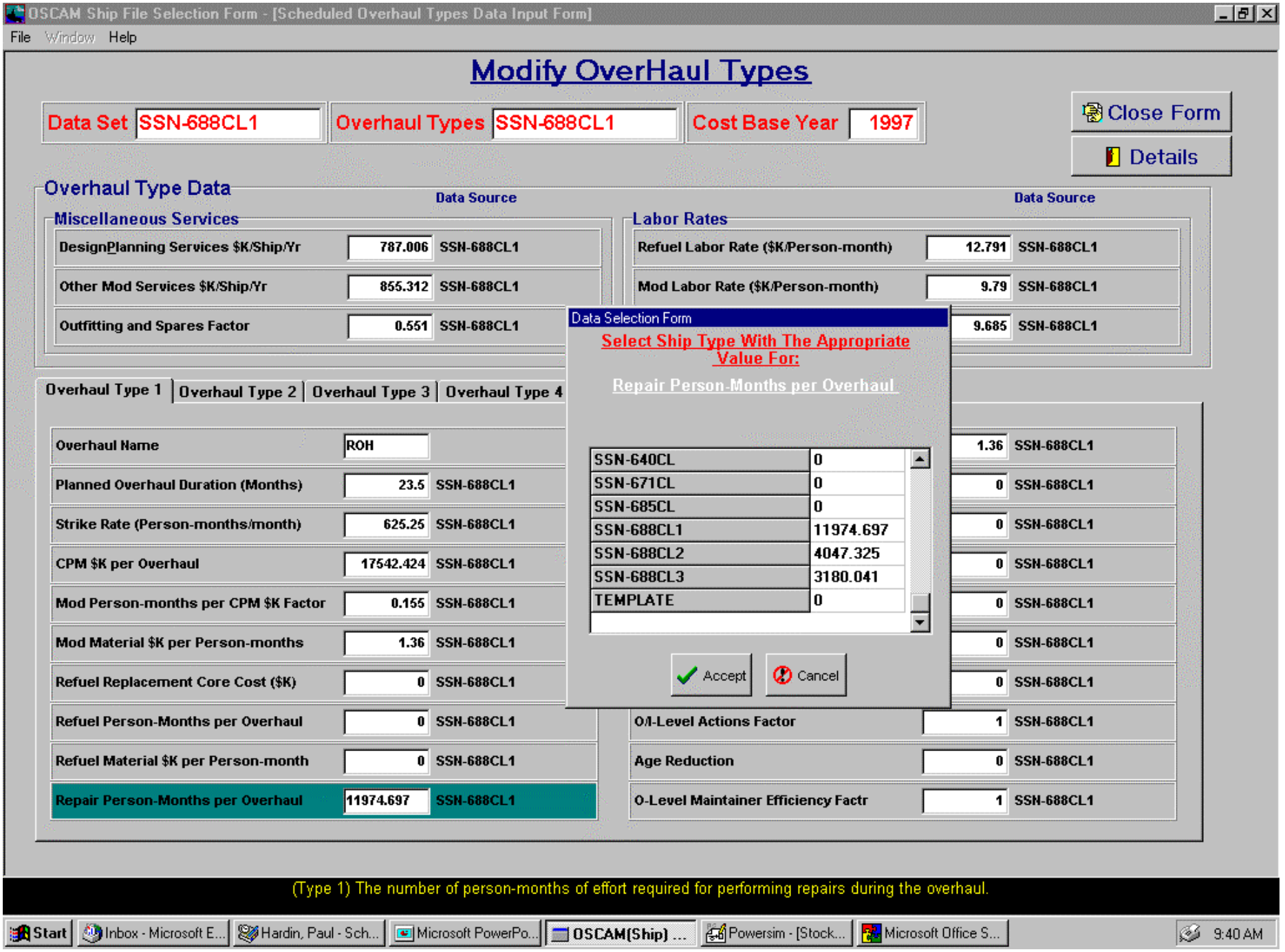
Ext Readiness Duration (mths): 0

Cumulative Centrally Provided Material Costs



The overhaul and ship lifetime profiles. The overhauls may be dragged and dropped using the left mouse button and editted using the right mouse button,

Start | Inbox - Microsoft E... | Hardin, Paul - Sch... | Microsoft PowerPo... | OSCAM(Ship) ... | Powersim - [Stock... | Microsoft Office S... | 9:35 AM


OSCAM Ship File Selection Form - [Scheduled Overhaul Types Data Input Form]
File Window Help
Modify OverHaul Types
Data Set SSN-688CL1
Overhaul Types SSN-688CL1
Cost Base Year 1997
Close Form
Details
Overhaul Type Data
Data Source
Miscellaneous Services
DesignPlanning Services $K/Ship/Yr 787.006 SSN-688CL1
Other Mod Services $K/Ship/Yr 855.312 SSN-688CL1
Outfitting and Spares Factor 0.551 SSN-688CL1
Data Source
Labor Rates
Refuel Labor Rate ($K/Person-month) 12.791 SSN-688CL1
Mod Labor Rate ($K/Person-month) 9.79 SSN-688CL1
9.685 SSN-688CL1
Data Selection Form
Select Ship Type With The Appropriate Value For:
Repair Person-Months per Overhaul
SSN-640CL 0
SSN-671CL 0
SSN-685CL 0
SSN-688CL1 11974.697
SSN-688CL2 4047.325
SSN-688CL3 3180.041
TEMPLATE 0
Accept
Cancel
Overhaul Type 1
Overhaul Type 2
Overhaul Type 3
Overhaul Type 4
Overhaul Name ROH
Planned Overhaul Duration (Months) 23.5 SSN-688CL1
Strike Rate (Person-months/month) 625.25 SSN-688CL1
CPM $K per Overhaul 17542.424 SSN-688CL1
Mod Person-months per CPM $K Factor 0.155 SSN-688CL1
Mod Material $K per Person-months 1.36 SSN-688CL1
Refuel Replacement Core Cost ($K) 0 SSN-688CL1
Refuel Person-Months per Overhaul 0 SSN-688CL1
Refuel Material $K per Person-month 0 SSN-688CL1
Repair Person-Months per Overhaul 11974.697 SSN-688CL1
1.36 SSN-688CL1
0 SSN-688CL1
0 SSN-688CL1
0 SSN-688CL1
0 SSN-688CL1
0 SSN-688CL1
0 SSN-688CL1
O/I-Level Actions Factor 1 SSN-688CL1
Age Reduction 0 SSN-688CL1
O-Level Maintainer Efficiency Factr 1 SSN-688CL1
(Type 1) The number of person-months of effort required for performing repairs during the overhaul.
Start
Inbox - Microsoft E...
Hardin, Paul - Sch...
Microsoft PowerPo...
OSCAM(Ship) ...
Powersim - [Stock...
Microsoft Office S...
9:40 AM

OSCAM Ship File Selection Form - [Results Display Form]

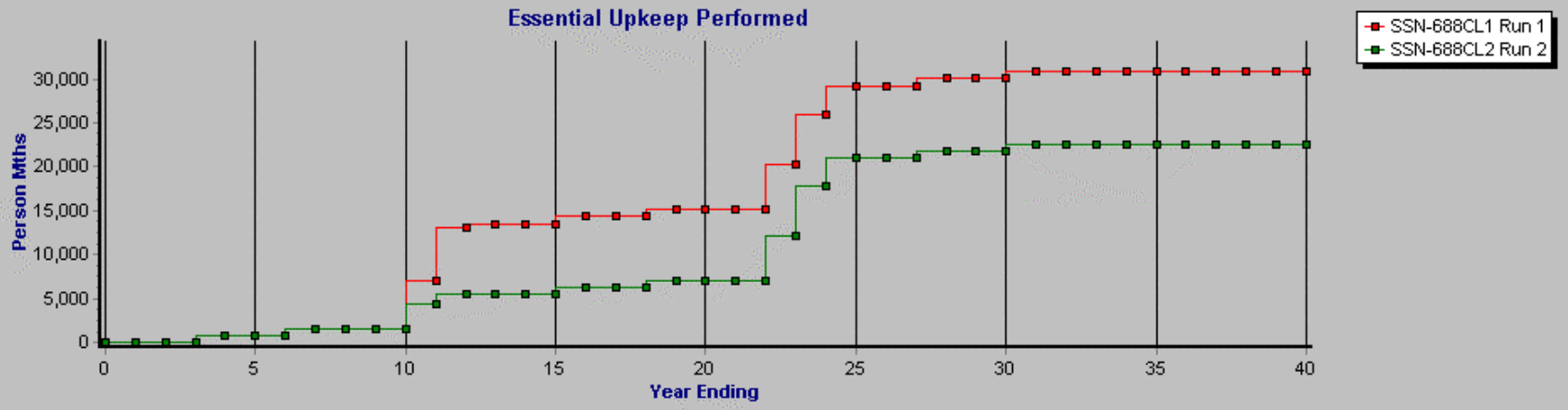
File Window Help

Current Data Set	SSN-688CL2	Programme Profile	SSN-688CL1	Cost Base Year	1997

Print Graph | Configure Table | Delete Results | Close Form

Year Ending	0	1	2	3	4	5	6	7	8
57 I Level (Afl) Alteration (Person Hours)	0.000	369.188	402.750	402.750	402.750	402.750	402.750	402.750	402.750
58 O-Level Downtime (2nd Lev) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
59 I-Level Downtime (2nd Lev) (Hours)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60 Outstanding O-Level Actions (2nd Lev) (Actions)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
61 Outstanding I-Level Actions (2nd Lev) (Actions)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
62 Essential Upkeep Performed (Person Mths)	0.000	0.000	0.000	0.000	784.690	784.690	784.690	1,569.380	1,569.380
63 Discretionary Upkeep Performed (Person Mths)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
64 Spare Overhaul Effort (Person Mths)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
65 Retained Upkeep Actions (2nd Lev) (Person Mths)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
66 Discarded Upkeep Actions (2nd Lev) (Person Mths)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

SSN-688CL1 Run 1 | SSN-688CL2 Run 2



This is the results table for each run. Double click a row (not the left most column) to show that data in the graph.

Start | Inbox - Microsoft Exch... | Hardin, Paul - Schedul... | Microsoft PowerPoint -... | OSCAM(Ship) V2.0 | Powersim - [Stock/Flo... | Microsoft Office Short... | 10:39 AM